Amalgam, GIC and Composite use in children
Study objectives

• Discuss amalgam restorations
• Discuss resin restorations
• Describe the history and evolution of use of silicate cement
• Discuss the role and importance of other cements in paediatric dentistry
Introduction

The choice of a material to be used in a given situation in a child is usually not easy. There are a number of factors that affect the choice of material for use. These include the following:
1. Durability of material of choice: This affects the choice of the material vis a vis the length of time the tooth needs to stay in the mouth.
2. **Age of the patient**: This dictates cooperative ability and the length of time the material needs to stay in the mouth.
3. **Caries risk**: materials used in a child with high risk for caries would slightly differ from choices to be made in a child with low caries risk.
4. Techniques sensitivity of materials: one may choose to use a more forgiving material like amalgam in a less cooperative child than GIC for posterior restoration. Could GIC rather than composite as anterior restorative material in a less cooperative child.
Amalgam

- Dental amalgam is an alloy of mercury with another metal in various composition. These are silver (69%), tin (17%), copper (13%) and zinc (1%).
- Long been used as restorative material for both the 1^o and 2^o teeth. It still remains the most commonly used material.
• The modern high copper amalgam alloys have better marginal integrity thereby reducing amalgam’s tendency for marginal breakdown. This is because it creeps less. Also, surface corrosion is considerably reduced as gamma 2 particles are not produced. What is produced is Cu$_6$Sn$_5$ which is also prone to corrosion but less so.
Setback of amalgam

- However the setback of amalgam continues to be lack of bond with tooth substance leading to marginal leakage and possibly secondary caries.
Setback of amalgam - 2

- Amalgam toxicity for dental practitioners and the patient has continued to be stressed. Patient with large number of fillings may have incipient mercury leakage that could cause mercury toxicity. This reduces the interest of use of this material in patients who need large number of fillings.
Setback of amalgam - 3

- Mercury have been demonstrated to leak into tooth structure causing discolouration; as well as into the pulp tissue.
Use of amalgam in children

- Amalgam needs a depth of at least 1.5mm to prevent its fracture.
- However in children, the thickness of enamel and dentine is less than that found in the permanent dentition, and the pulp horn is also high. Depth of 2mm to accommodate lining may result in pulpal exposure.
Use of amalgam in children - 2

- In primary molars, the enamel rods are inclined occlusally.
- For this reason, the cavosurface margins of the cavity prepared on the primary molars should be sharp otherwise you have supported enamel.
Use of amalgam in children - 3

- For best results, do not use amalgam in primary teeth requiring restorations on more than two surfaces.
- It is advisable to use cavity varnishes, and for deep cavities, cavity liners and varnishes before the placement of amalgam as this protects the exposed dentine and reduces subsequent trauma to the pulp.
• For best result, use dental amalgam alloys that are zinc free where moisture control may be a problem. This is because contamination with water before setting results in reaction with zinc, release of hydrogen, the pressure from released hydrogen causes amalgam flow and expansion evident a few days after insertion of restoration. This in turn, causes filling to protrude from the cavity resulting in failure.
Use of amalgam in children - 5

- At the end of the restoration, burnish and polish the amalgam surface. You burnish to remove excess materials from the margins of the restoration. Your polishing amalgam increases resistance to corrosion and tarnish and reduces the tendency for recurrent caries and marginal failure.
Composite resin

- Composite resin are used for both anterior and posterior teeth restoration.
- While there are a lot of advocacy for the substitution of dental amalgam use composite, there are some peculiarities about composite that raises questions about the possibility of its routine use in primary teeth restoration.
Advantages of composite resin

1. Eliminates mercury in the dental environment
2. Improved appearance and aesthetics
3. Reduced thermal stimulation of the pulp
4. Colour matching potential
5. Bonds with tooth material (especially enamel)
6. Longevity (with proper technique, should last up to 10 years)
Idiosyncrasies with composite resin

- Composite is the material of choice for anterior restoration because of aesthetics. For posterior teeth, composite use should be limited to small cavities. Its use with larger cavities increases the shrinkage and possibility of marginal leakage resulting from intra-material fracture.
Before material is inserted, the enamel margins should be etched as this increases the retention. However in primary dentition, the outer surface of the enamel is prismless and this does not respond well to etching. Retention is increased significantly if a diamond small round bur is used to remove the prismless surface and then the rest of the enamel is etched.
Idiosyncrasies with composite resin - 3

- For the posterior teeth, because composite are not as condensable as amalgam, interproximal contacts are often open. To overcome this, the operator should prewedge the teeth before cavity preparation, and burnish the matrix band against the proximal surface of the adjacent teeth before insertion of the composite.
Idiosyncrasies with composite resin - 4

- Use of a bonding or coupling agent increases the retention strength of composite.
- Postoperative sensitivity reported in permanent dentition which results from material shrinkage has not been reported in the primary dentition.
- Its use is difficult in class II cavities as it is difficult to etch the gingival margin of the proximal box. Thus defects at the gingival margin is common.
Idiosyncrasies with composite resin - 5

- For posterior restoration, the use of intermediate or hybrid composite has addressed the issue of strength and occlusal wear that were problems in the past. However, there is a need to use a 45° bevel at the cavosurface margin for good finishing.
Operator instructions

- The light cured composite have considerable handling advantage over the chemically activated form. It gives good working time. It is also more colour stable. The visible light cured resin, an advancement over the light cured composite, contains a photosensitive activator (ketones) which does not set unless activated by the ultraviolet light. Light cure also allows for incremental curing which reduces the tendency for shrinkage.
Operator instructions - 2

- For deep cavities, apply a calcium hydroxide sublining to protect the pulp.
- With composite, use plastic instruments and not metal instruments to prevent changing the color of composite.
Disadvantages of composite resin

1. Shrinkage during polymerisation affecting marginal adaptation.
2. Pulpal protection with an appropriate liner necessary.
3. Appearance of microscopic voids which could cause recurrent caries if a rigid technique is not used.
Disadvantages of composite resin - 2

4. Possible open interproximal contacts.
5. Increased tendency to extensive abrasion of functional occlusal surfaces when used as a posterior restorative material.
Glass ionomer cement

- Glass ionomer cements are ion-leachable by aqueous polyacrylic acid. The cement powder is finely ground calcium aluminum fluorosilicate glass. The powder is combined with a solution of polyacrylic acid, maleic acid and tartaric acid.

- Its strength is increased with the addition of silver particles to the powder. This is known as ‘cermet’. Cermet however has low fracture toughness.
Uses of GIC in children dentistry

- Can be used as a cavity liner for restorative materials like amalgam and composite. It serves as a thermal insulator.
- Can be used as a luting agent for orthodontic appliances, stainless steel crowns.
Uses of GIC in children dentistry - 2

• Can be used along with composite in the restoration of deep cavities. The sandwich technique makes use of the greater bonding strength of GIC to dentine to increase the bond strength of composite.

• Used as fissure sealant in the management of caries. Its high viscosity limits its use as a fissure sealant.
Uses of GIC in children dentistry - 3

- Good restorative material for class II and class III restorations in low stress-bearing areas.
- Can be used for indirect pulp capping in primary and permanent dentition.
- Can be used for direct pulp capping in the permanent dentition.
Uses of GIC in children dentistry - 4

• It is a suitable restorative material in the primary teeth. Its survives for a period of 3 – 5 years in the mouth with a medium survival rate of 3 years.
• Clinical success in primary molars shows that the GIC use should be limited to small lesions, and for teeth that will exfoliate within a year.
Uses of GIC in children dentistry - 5

- When used in the primary teeth to restore marginal ridges, it is better to leave those restored ridges out of occlusion so as to ensure longevity.
- It is also important to make retention forms for GIC on the primary teeth so as to aid its retention.
Uses of GIC in children dentistry - 6

- Bulk placement of not less than 1mm is important in occlusal lesions so as to prevent fracture at the istmus, a common point of fracture because of the thin labio-lingual diameter.
- The fluoride leaching and fluoride absorbing properties makes its of great use as a caries prevention material.
Finishing GIC restorations

• After restoration, it is important to cover GIC with a glazing or bonding agent. This decreases the dehydration tendency that could cause creezing of the material due to shrinkage, crack formation and undue stress on the newly formed ionic exchange layer at the interphase between the material and the tooth structure. This crack is usually intra-material.
• Polish after 24 hours.
• Where aesthetic is paramount, use sandwich technique.
Causes of failure of GIC restoration

- Dehydration.
- Early exposure of material to fluid. It is a technique sensitive material.
- Working of material into cavity after it has lost its gloss. Once gloss is loss, the tendency to bond to dentine is decreased.
- Easy wear when used in stress bearing areas.
Quiz 1

Amalgam restorations in deciduous dentition:

a. Appropriate depth of cavity is 2mm
b. Bevel cavosurface margins because enamel rods are included occlusally
c. Amalgam not appropriate for use in lesions with two surfaces
d. Use amalgam with zinc for patients with moisture control
Quiz 2

Composite:

a. Bond is good with deciduous molars once enamel is etched
b. Important to remove outer enamel prior to etching
c. Marginal leakage causes deciduous tooth sensitivity with use of material
d. Zinc oxide eugenol lining appropriate for material
e. Chemical cure composite more colour stable
A six year old child comes into the clinic with multiple caries lesions. On examination, all the second deciduous molars are carious. The patient is dentally anxious.

1. Based on the four criteria for selection of dental restorative material, justify the material you will use for the final restoration for this child.

2. How may this be different if it is a second permanent molar?

3. Briefly outline your management plan for this child.
Reference reading material

Acknowledgement

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• The slides was developed and updated from multiple materials over the years. We have lost track of the various references used for the development of the slides

• We hereby acknowledge that many of the materials are not primary quotes of the group.

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